Moving beyond species-specific noise-induced changes in birdsong: A comment on Roca et al.

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Anthropogenic (man-made) noise is a global pollutant of international concern. While the impacts of anthropogenic noise on humans have been studied for decades (Muzet 2007), it is only in the last 10–15 years that similar attention has focussed on non-human animals (Shannon et al. 2016). Some of the earliest work considered how vocal signallers might overcome potential masking, with research investigating changes in song frequency by birds leading the way (Slabbekoorn and Peet 2003). Studies on shifting song frequencies continue to dominate the anthropogenic-noise literature, and so the meta-analysis conducted by Roca et al. (2016), drawing together and comparing these studies, is timely and welcome.

Roca et al. (2016) demonstrate that bird species differ in whether and how they alter their song frequencies when faced with anthropogenic noise. Such inter-specific variation has also been documented with respect to other behaviours (Francis et al. 2011; Voellmy et al. 2014), and is to be expected due to differences in, for instance, physiological stress responses and hearing thresholds (Hofer and East 1998; Manley 2012), as well as the variation in body size and vocal characteristics discussed by Roca et al. (2016). Since inter-specific differences may alter relative success under conditions of anthropogenic disturbance, studies that start to establish which species are most at risk and if there are generalizable patterns in response are important, both for a full understanding of the impacts of anthropogenic noise and to best-inform potential mitigation measures.

Given the preponderance of such studies, Roca et al. (2016) sensibly focus their meta-analysis on birdsong (and also consider anurans). However, they rightly point out two extensions that are needed in this research field. First, that more work considers acoustic communication in other taxa (see also Morley et al. 2014; Radford et al. 2014). It is likely that there will be effects on the vocalisations of mammals (Parks et al. 2011), as well as the wider range of acoustic signals produced by fish (Picciulin et al. 2012) and insects (Lampe et al. 2012). Second, that there should be investigations of acoustic signals that are not sexually selected (i.e. that function in mate attraction and territory defence). Early evidence suggests that anthropogenic noise could also affect, for example, signalling about danger (Lowry et al. 2012) and communication between parents (Halfwerk et al. 2012) and between parents and offspring (Leonard and Horn 2012).

I suggest that for a complete picture of how anthropogenic noise impacts acoustic communication, three further elements are crucial. First, there is the need to consider not just the signaller but also the receiver. Singing at a higher pitch, for instance, is not necessarily a guarantee of success for bird species in urbanised environments (Moiron et al. 2015). Second, there should be greater consideration of the costs, as well as the potential benefits, of vocal adjustments (Read et al. 2014). Alterations in acoustic characteristics could result in many direct or indirect costs, including reduced transmission distances, increased risk of predation or parasitism, higher energy expenditure, and loss of vital information. Finally, and not unrelated to the above, fitness consequences ideally need to be assessed. Studies directly measuring how anthropogenic noise affects survival or reproductive success are rare, both with respect to acoustic communication (but see Halfwerk et al. 2011) and more generally (but see Simpson et al. 2016). However, they are ultimately required if we are to determine the consequences of this pervasive pollutant for population viability and community structure.

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